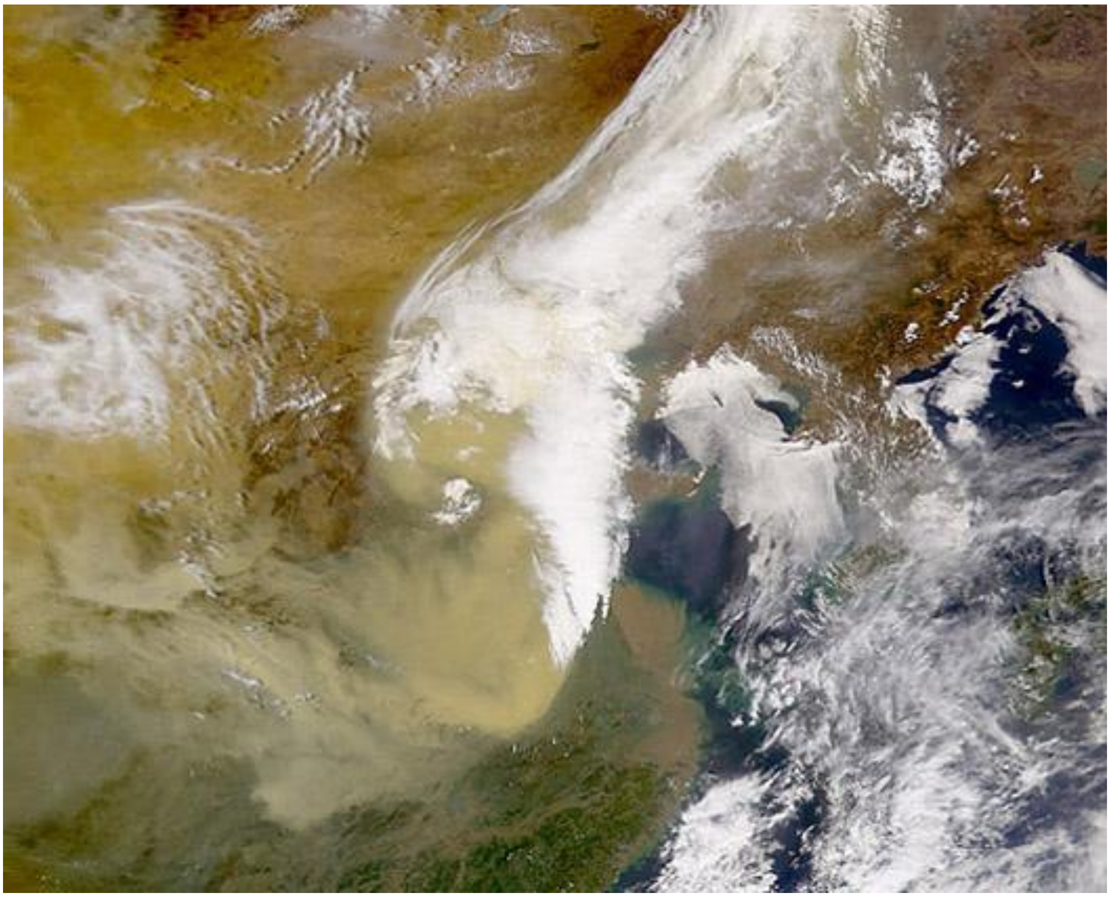
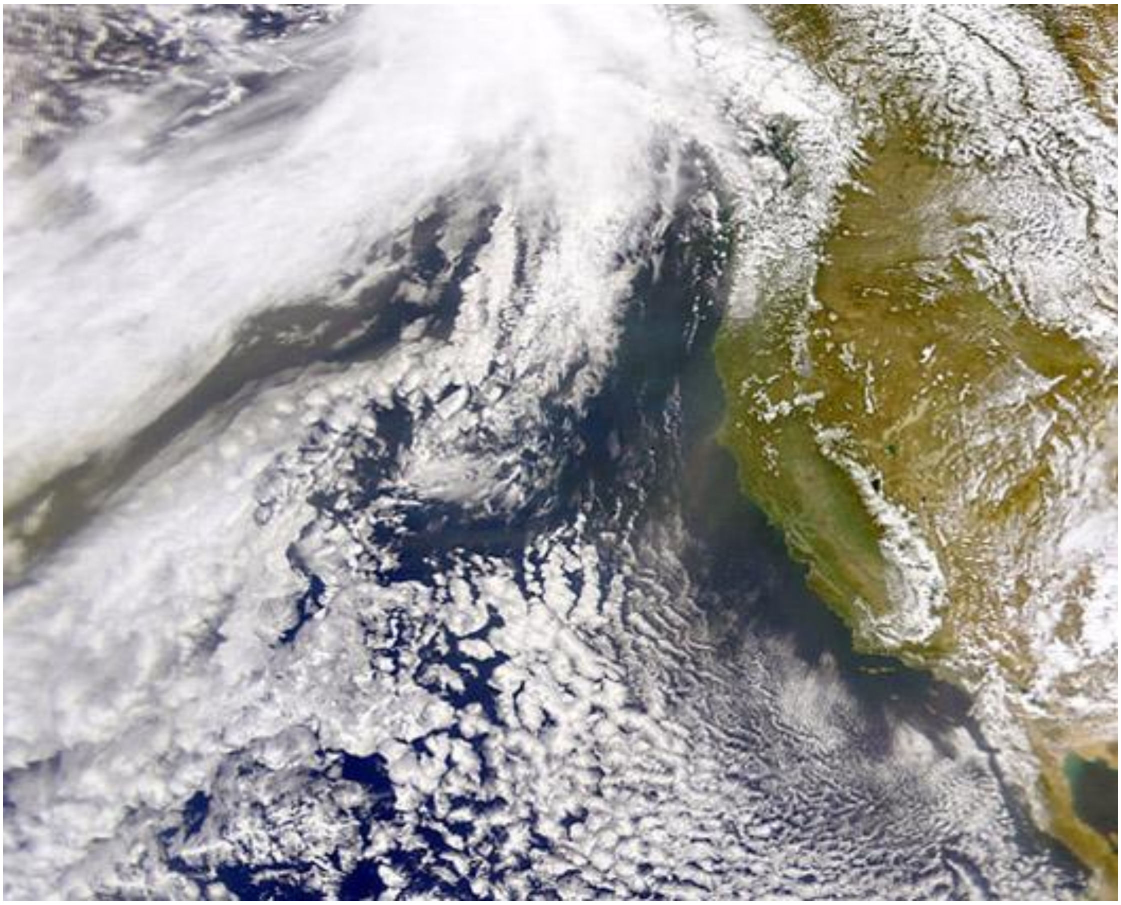
SCIENCE FOCUS: ASIAN DUST

SeaWiFS Observes Transport of Asian Dust over the Pacific Ocean



These SeaWiFS images show the development of large dust storms in China and their interaction with a meteorological system that carried the dust far out into the Pacific Ocean. In the image above, from April 16, 1998, the bright yellowish-brown cloud near the coast is the center of a dust storm, being pushed by a frontal system. A sequence of images from April 20-24 at the end of this article shows the atmospheric circulation around a second, stronger low-pressure system entraining more Gobi Desert dust and carrying it over the North Pacific Ocean.

On April 25, dust from this event reached the west coast of North America (image below).



SeaWiFS image of the west coast of North America on April 25, showing the arrival of airborne dust from China. The dust is visible in the clouds at the center of the left edge of the image, and as streaks of light-brown haze over Cape Mendocino on the California coast.

Washington University in St. Louis hosted a virtual workgroup (which was still unusual in 1998) to analyze the propagation of this Asian dust event. Some of the additional analyses and other images of this event are still available at the link.

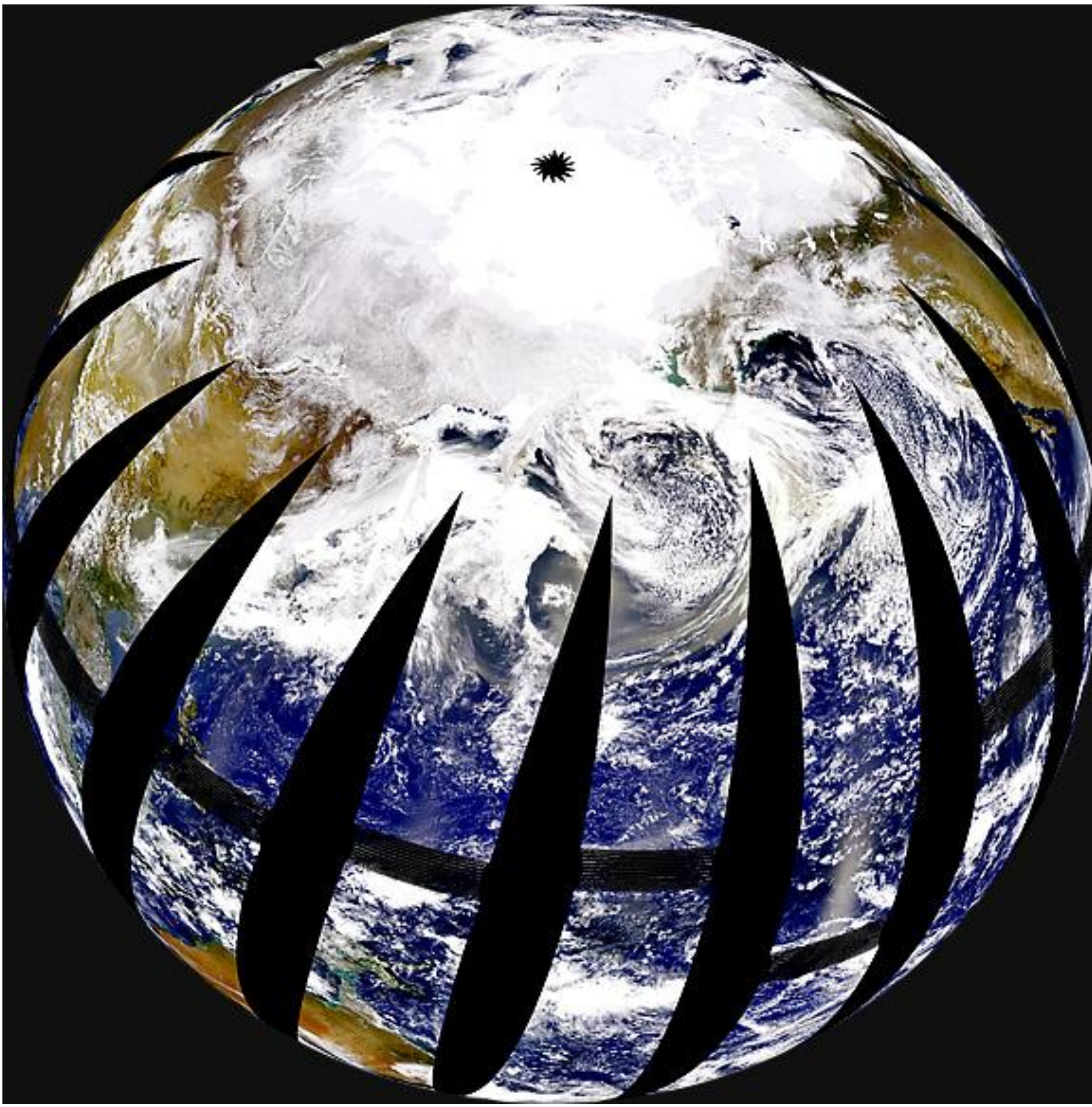
The paper entitled "The Asian Dust Events of April 1998" by Husar and 28 co-authors (Journal of Geophysical Research - Atmospheres, **106 (D16),** 18317-18330, August 27, 2001) discussed these events.

Dust from large deserts that is transported in this manner can be a vital nutrient source for both the oceans and terrestrial ecosystems. Iron in the minerals composing this desert dust will be a vital nutrient in oceanic regions that are deficient in iron. Furthermore, research has shown that the canopy (top layers) of much of the Central and South America rain forest derives much of its nutrient supply from dust that is transported over the Atlantic from the Sahara Desert in northern Africa. Saharan dust occasionally reaches the state of Florida, causing a characteristic high-altitude haziness that obscures the Sun.

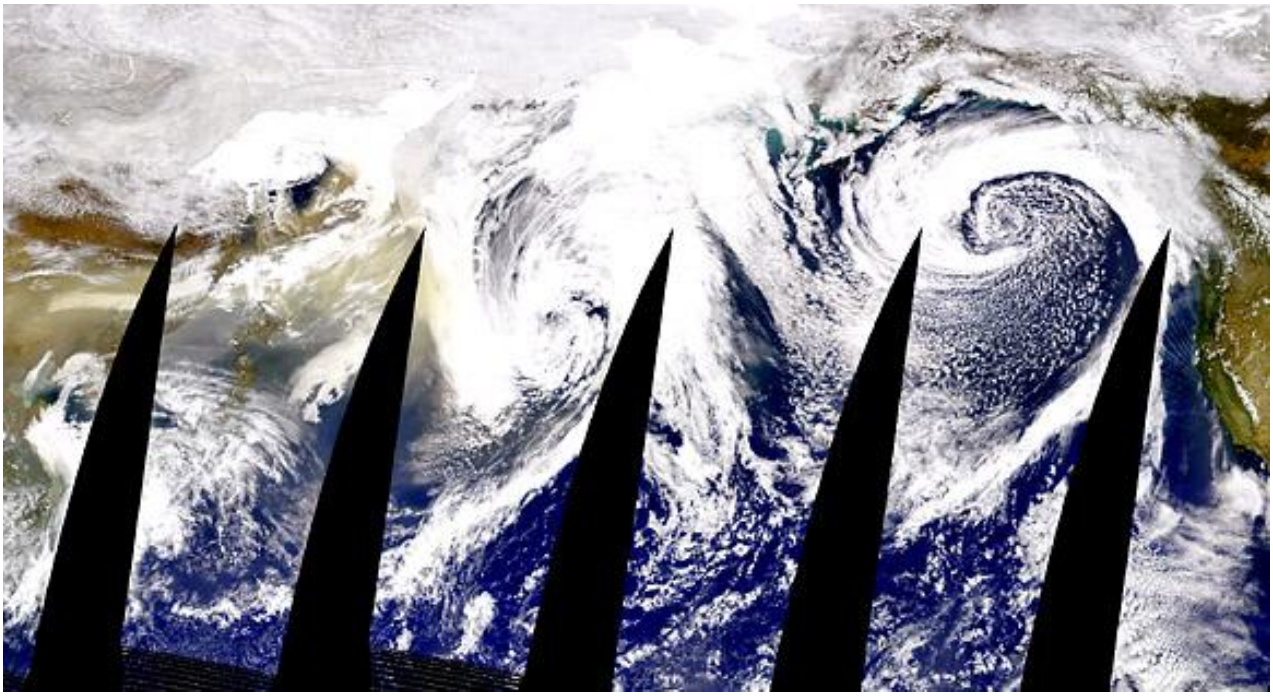
Research performed during the Asian Dust Input to the Oceanic System (ADIOS) project showed that dust particles from China's Gobi Desert were transported all the way to Hawaii. Some of these dust particles were "giant" particles, much larger than standard models of dust transport indicated could be carried that far. Furthermore, as the dust settled into the waters around Hawaii, the primary productivity of the plankton in the water column increased, just as predicted by John Martin's "iron fertilization" hypothesis. This research took place in the mid-1980's, before ocean fertilization experiments off the Galapagos Islands, providing additional evidence that Martin's idea was correct.

Interestingly, during colder periods in Earth's climate history, desert areas appear to get larger. During these periods, dust from the deserts was likely transported to the oceans, where it augmented photosynthesis, which removed additional carbon dioxide from the atmosphere. In this manner, the global "thermostat" of carbon dioxide in the atmosphere was maintained at a low level, prolonging the cool conditions. Other climatic effects must come into play so that increasing global temperatures can override this feedback mechanism of the global climate. In fact, due to this connection, John Martin suggested that with enough iron added to the oceans, a new "Ice Age" could be created. Though that level of global climate control is still beyond human capabilities, the interaction of land and ocean in moderating global climate was well-illustrated by his statement.

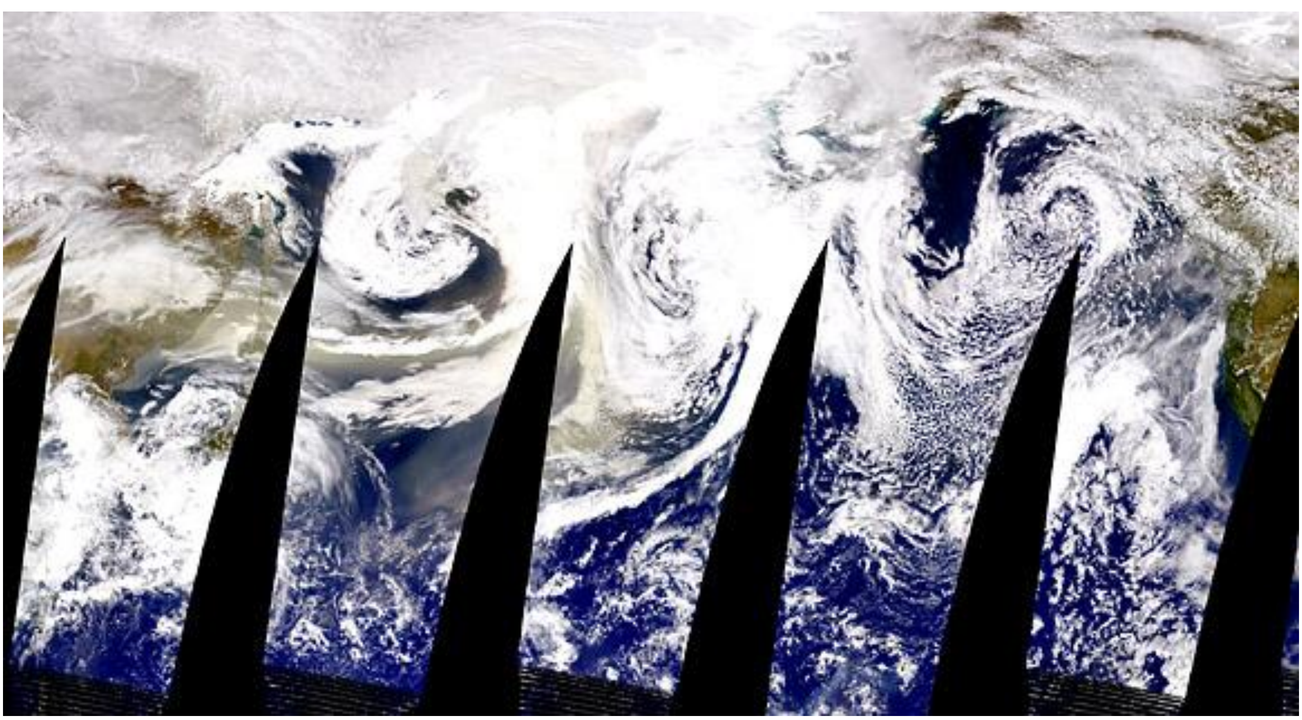
Hemispheric image showing dust just north of Hawaii on April 23, 1998. The black gaps are the spaces between SeaWiFS scanning swaths on a single day of observations. The black horizontal areas are tilt segments where the instrument was tilted to improve data quality.



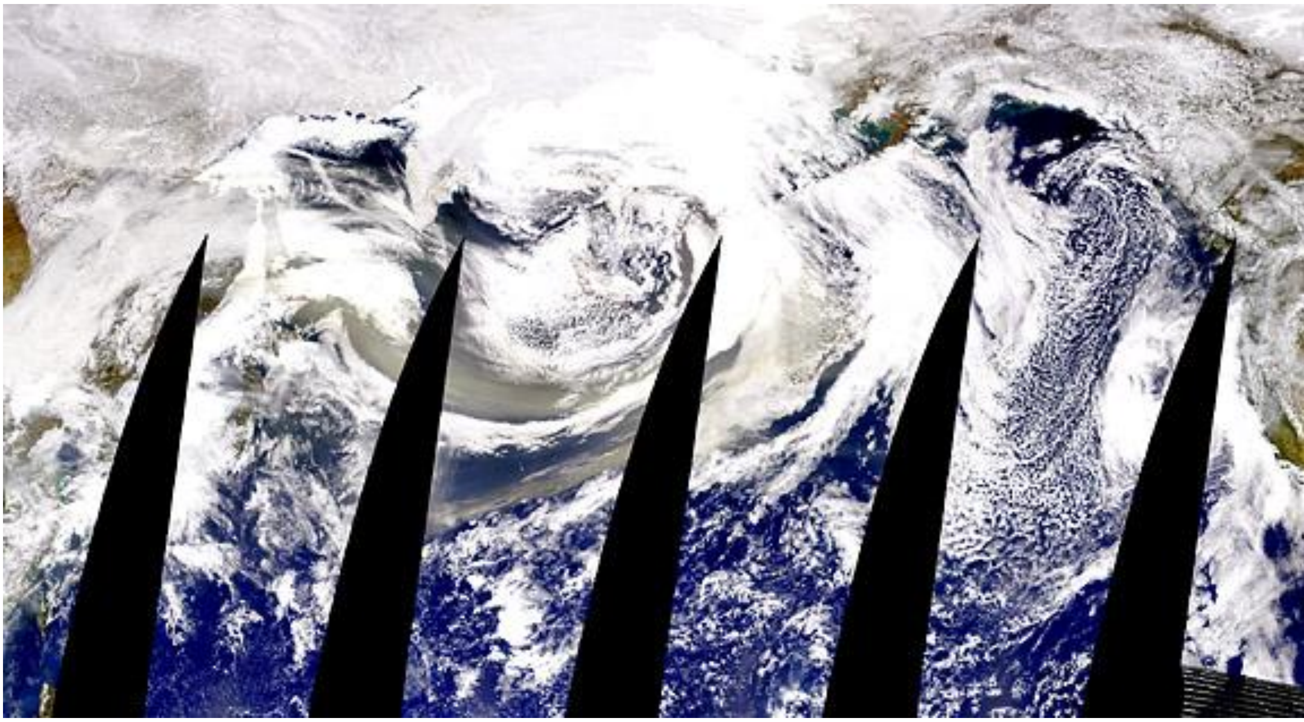
Asian dust storm image sequence



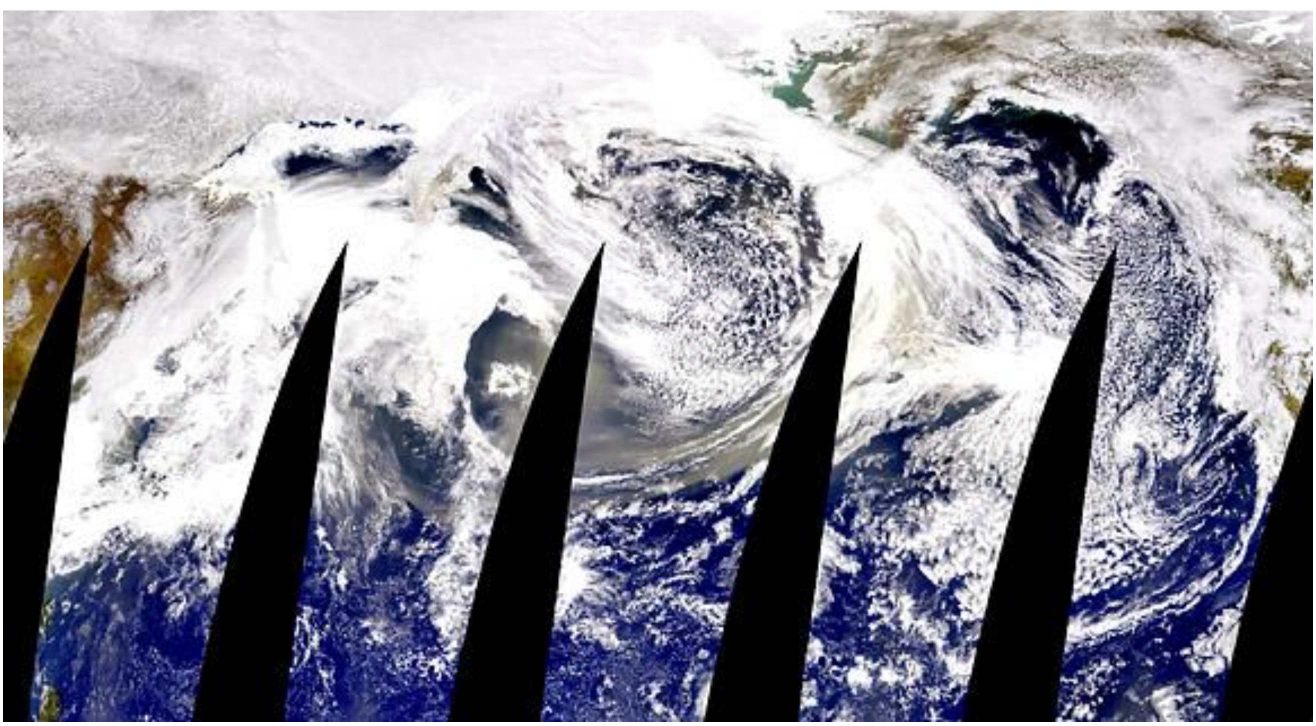
April 20: Bright yellow-brown dust aerosols being captured by the storm forming over the northwest Pacific. A comma-shaped developed storm in the northeast Pacific can also be seen in this image.



April 21: Further development of the storm, dust streaming off the coast of China, and rapid transport of dust into the central north Pacific.



April 22: Much of the dust has now been incorporated into the circulation of the storm.



April 23: This image illustrates how effectively the storm has transported dust from China into the central north Pacific Ocean.

April 24: Continuing dust transport can be seen in this image. Also note the turquoise blue colors of a coccolithophore bloom in the Bering Sea west of Alaska.

The images in the sequence were generated from SeaWiFS Global Area Coverage (GAC) daily data.

ACKNOWLEDGMENT

SeaWiFS images produced by Norman Kuring.

Original Web page design by Robert Simmon.

Accompanying text by James Acker.